IMT-2000 members UTRA-TDD and UTRA-FDD

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UTRA (FDD + TDD)

- IMT-2000 and UMTS-UTRAN
- The need for 3G
- History, progress and elaboration of UMTS-UTRAN
- Characteristics and capabilities
- Conclusion
IMT-2000 Terrestrial Radio Interfaces

- CDMA
  - Direct Spread
    - UTRA FDD
    - cdma2000
  - Multi Carrier
    - 3GPP2
- TDMA
  - Single Carrier
    - UWC-136
    - TIA TR45.3
  - TM-1A / TDMA
    - DECT
    - ETSI
IMT-2000 Terrestrial Radio Interfaces

CDMA
- Direct Spread
  - UTRA FDD
  - UMTS

TDMA
- TDD
  - UTRA TDD
  - LCR / HCR

UMTS
UTRA (FDD + TDD)

Organizational Partners

3GPP is:
- Open to all national/regional Standards Development Organizations irrespective of their geographical location *(Organizational Partners)*

-CWTS-

-Arib-

-TTC Telecommunication Technology Committee-

-ETSI-

-TTA-

-Standards Committee T1 Telecommunications-
UTRA (FDD + TDD)

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The Three Driving Forces Towards UMTS

**3G / UMTS**

**Universal Mobile Telecommunication System**

- **End-user demand**
  (anytime, anywhere)

- **New services and applications**
  (enabler: GPRS, HSCSD)

- **Capacity shortage**
  (PDC, GSM900, hot spots)
UMTS Services Evolve from 2G Services
Tomorrow’s Service Demand Requires High Data Rates

UMTS will deliver seamless services from narrowband to broadband and will support flexible bandwidth on demand up to 2 Mb/s

Many UMTS services are also possible with 2.5G but only 3G allows for sufficient simultaneous service users per cell.
Expected User Preferences:
mobile terminals will be the natural interface to access the Internet and Value Added Services

<table>
<thead>
<tr>
<th>PC</th>
<th>CABLE-TV</th>
<th>MOBILE PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998 Actual PC Installed Base: <strong>298 Million</strong></td>
<td>1998 Actual Cable-TV Installed Base: <strong>199 Million</strong></td>
<td>1998 Actual Global Subscriber Base: <strong>290 Million</strong></td>
</tr>
<tr>
<td>2003 Estimated PC Installed Base: <strong>550 Million</strong></td>
<td>2003 Estimated Cable-TV Installed Base: <strong>260 Million</strong></td>
<td>2003 Estimated Global Subscriber Base: <strong>1 Billion</strong></td>
</tr>
</tbody>
</table>

Sources: CSFB, Dataquest
IMT-2000 and UMTS-UTRAN

The need for 3G

History, progress and elaboration of UMTS-UTRAN

Characteristics and capabilities

Conclusion
## A Brief History of UMTS Progress

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 1998</td>
<td>Paris</td>
<td>ETSI selects W-CDMA for paired (FDD) and TD-CDMA for unpaired (TDD) UMTS-operation out of 5 competing modes</td>
</tr>
<tr>
<td>Nov. 1999</td>
<td>Helsinki</td>
<td>ITU approves IMT-2000 Radio Interface specifications including FDD- and TDD mode approved in ITU meeting (M.1457)</td>
</tr>
<tr>
<td>Dec. 1999</td>
<td>Nice</td>
<td>3GPP approves UMTS Release‘99 specifications both for FDD and TDD</td>
</tr>
<tr>
<td>Mar. 2001</td>
<td>Palm Springs</td>
<td>3GPP approves UMTS Release 4 specifications both for FDD and TDD</td>
</tr>
</tbody>
</table>
## Frequency Ranges of Second and Third Generation

### ITU Allocations for 3G

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe, China</td>
<td>1885-2025</td>
</tr>
<tr>
<td>Japan</td>
<td>1710-1980</td>
</tr>
<tr>
<td>USA</td>
<td>850-2200</td>
</tr>
</tbody>
</table>

### Brazil, Peru, Colombia, Venezuela, Bolivia, Uruguay tend to use UMTS

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*[Image: SIEMENS Frequency Ranges of Second and Third Generation diagram]*
3GPP RAN - Standardisation Body for UTRA-TDD and -FDD

3GPP internal structure

Project Co-ordination Group (PCG)

TSG Radio Access Network
TSG Core Network
TSG Terminals
TSG Service and System Aspects
TSG GSM/EDGE Radio Access Network

Technical Specifications
# UTRAN Specifications of 3GPP RAN

## General
- 25.301: Radio Interface Protocol Architecture
- 25.302: Services provided by the physical layer
- 25.304: UE Procedures in Idle mode and Procedures for Cell Reselection in Connected Mode

## Layer 3 RRC
- 25.331: Description of the RRC Protocol

## Layer 2 MAC/RLC
- 25.322: Description of the RLC protocol

## Layer 1 PHY
- **FDD**
  - 25.211: Transport Channels and Physical Channels (FDD)
  - 25.212: Multiplexing and Channel Coding (FDD)
  - 25.213: Spreading and Modulation (FDD)
- **TDD**
  - 25.221: Transport Channels and Physical Channels (TDD)
  - 25.222: Multiplexing and Channel Coding (TDD)
  - 25.223: Spreading and Modulation (TDD)

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1 UTRAN - 2 Modes

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**IMT-2000_UTRA_TDD_FDD_14**

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UTRAN architecture

FDD and TDD Node B can be operated at one RNC

Legend
UTRAN - UMTS Terrestrial Radio Access Network
RNC - Radio Network Controller
UE - User Equipment
UTRA (FDD + TDD)

- IMT-2000 and UMTS-UTRAN
- The need for 3G
- History, progress and elaboration of UMTS-UTRAN
- Characteristics and capabilities
- Conclusion
Characteristics and Capabilities: Different Radio Modes with Harmonized Parameter Sets

<table>
<thead>
<tr>
<th>Multiplex technology</th>
<th>FDD - Component</th>
<th>TDD - Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W-CDMA</td>
<td>TD-CDMA</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>2*5 MHz paired</td>
<td>1*5 MHz unpaired</td>
</tr>
<tr>
<td>Frequency Re-use</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Handover</td>
<td>soft, softer (Interfreq.: hard)</td>
<td>hard</td>
</tr>
<tr>
<td>Modulation</td>
<td>QPSK</td>
<td>QPSK</td>
</tr>
<tr>
<td>Receiver</td>
<td>Rake</td>
<td>Joint Detection</td>
</tr>
<tr>
<td>Chip Rate</td>
<td>3.84 Mcps</td>
<td>Rake (Mobile Station)</td>
</tr>
<tr>
<td>Spreading Factor</td>
<td>4 – 256</td>
<td>1, 2, 4, 8, 16</td>
</tr>
<tr>
<td>Power Control*)</td>
<td>fast: every 667 µs¹)</td>
<td>slow: 100 cycles/s²)</td>
</tr>
<tr>
<td>Frame organisation</td>
<td>0.667 / 10 ms</td>
<td>0.667 / 10 ms</td>
</tr>
<tr>
<td>Timeslots/Frame</td>
<td>N.a.</td>
<td>15</td>
</tr>
</tbody>
</table>

| TD-SCDMA             |
| 1*1,6 MHz unpaired   |
| 1 (or 3)             |
| hard                 |

Block 1

1) 0.25 to 1.5 dB

¹) Range: 80 dB (UL); 30 dB (DL) in steps of......

²) 1, 2 or 3 dB
UMTS consists of 2 complementing radio options: FDD for paired bands and large area coverage and TDD for asymmetrical applications and hot spots.
UTRA modes

- Both with harmonised bandwidth, chiprate and pulse shape

**FDD mode**

- Up-link
- Down-link

**TDD mode**

- Up-link
- Down-link
UTRA-TDD mode
Asymmetrical traffic handling

Asymmetrical Traffic in UTRA TDD mode

Switching Point between Up- and Downlink
Multimedia Services & TDD

TDD can be perfectly matched to this asymmetry without wasting system capacity.
**Cell Structures for UMTS**

**Micro Cell (FDD-/TDD-Mode)**
- Range: some 50 – 300 m
  - Hot spots
  - Medium mobility (> 10 km/h)
  - Up to 384 kbps

**Macro Cell (FDD-Mode)**
- Range: 350 m up to 20 km (outdoor)
  - Suburban / rural
  - High mobility (vehicle speed)
  - Approximately 144 kbps

**'Indoor' Pico Cell (TDD-Mode)**
- Range: some 10 m
  - Office / Home environment and “vertical networks”
  - Low mobility (< 10 km/h)
  - Up to 2 Mbps

**Using separate spectrum for different cell layers simplifies radio network planning procedures**
Deployment of UTRA FDD and TDD Mode

- **FDD mode for**
  - coverage driven roll-out
  - public macro and micro cell environment
  - data rates up to 384 kbps for high mobility

- **TDD mode for**
  - small cells with more asymmetric traffic
  - asymmetrical and symmetric data rates up to 2 Mbps
  - public micro and pico cell environment
  - unlicensed cordless and public wireless local loop

→ **SIEMENS SUPPORTS BOTH UMTS MODES AND IS ABLE TO PROVIDE COMPLETE SOLUTIONS FOR 3G-SYSTEMS**
UTRA (FDD + TDD)

- Introduction - The need for 3G
- A brief history of UMTS progress
- History, progress and elaboration of UMTS-UTRAN
- Characteristics and capabilities
- Conclusion
UMTS satisfies the real needs of the end-user

- Personalized and highly customized
- More individual bandwidth
- Always-On
- Global roaming
- Seamless network, UMTS-GPRS-GSM
- Rich Multimedia services: Information, Transaction, Entertainment

= my services - anytime - anywhere - on my device
UMTS-UTRAN enhances capabilities of 2G:

- Lower Delays can be reached
  - Faster access, due to the new radio interface
  - Faster transmission, due to higher datarates per individual connection

- More and new spectrum is allocated (and more efficiently used!)
- Improves coverage in hotspot areas
- Handover to/from GSM/GPRS/GERAN is assured
UMTS will become the largest 3G market

**UMTS** more than 50% of market
Worldwide (incl. Japan)

**FDD**
Technology: W-CDMA

**TDD**

- **HCR:**
  Technology: TD-CDMA

- **LCR:**
  Technology: TD-SCDMA
In many countries UMTS-licenses have already been issued

3 - 5 licenses per country:
≥ 10 MHz paired plus
≥ 5 MHz unpaired
(mostly combined)

UMTS LICENSING TIMETABLE IN EUROPE

(Status: 05/01)
Thank you!